ETE - COMMISSIONING WITH CAREL

Rev.	*Date*	*Modification*
1	26/05/25	PHE module layout (pag. 3 – 6 – 8 – 9)

This document is deemed as *Classified*. This means that first circulation is limited to selected people, who must diffuse it only as strictly necessary for correct operations.

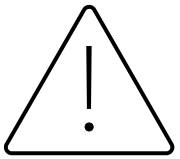
© *EPTA GROUP – ALL RIGHTS RESERVED*

Contents

© EPTA GROUP – ALL RIGHTS RESERVED

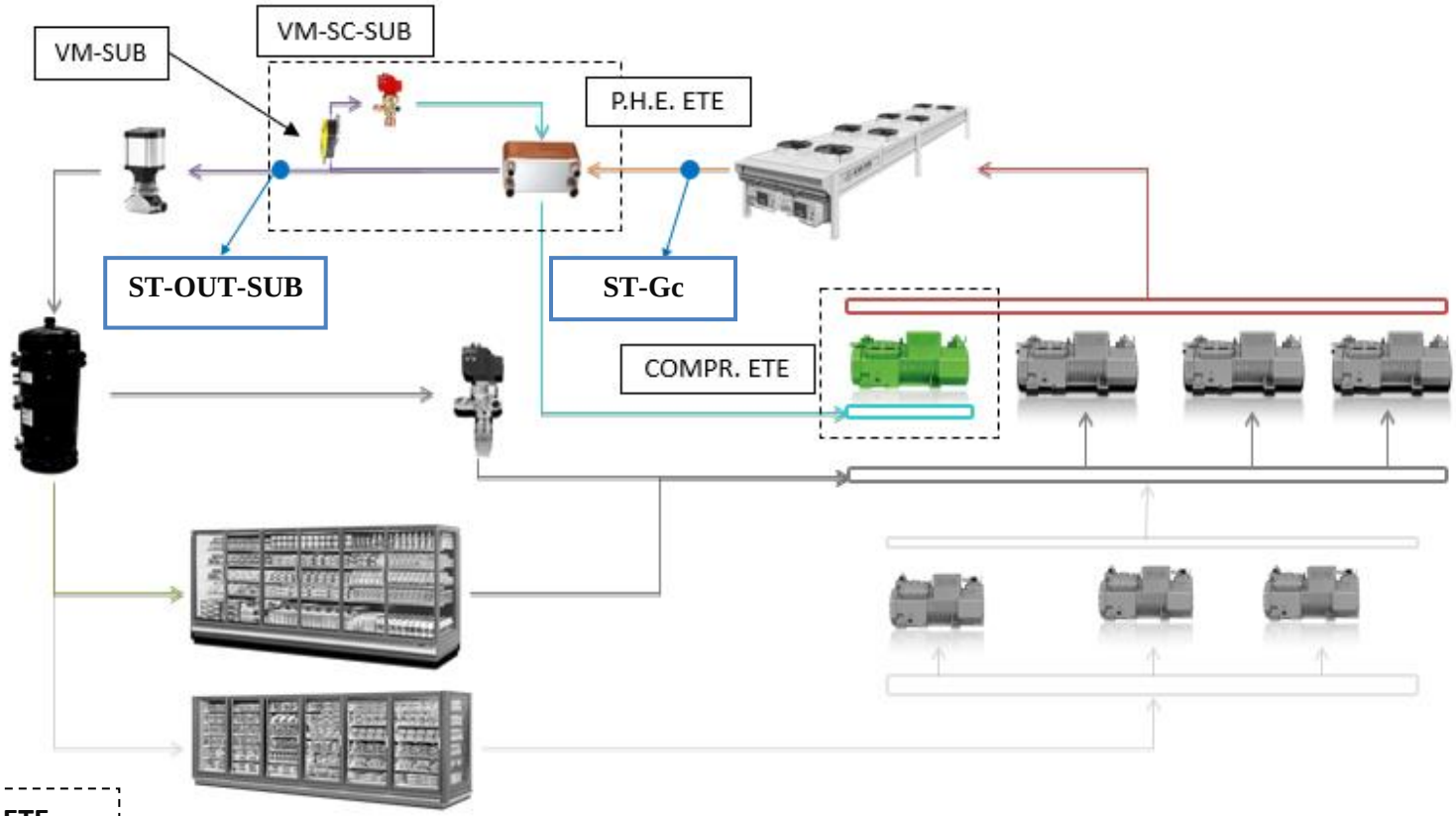
1. Concept layout of transcritical system with ETE

The system sensors for the ETE:

CODE	NOMENCLATURE	DEFINITION	TYPE	DESCRIPTION
	VM-SC-SUB	Electronic Expansion Valve of ETE	Component	EEV that expand a quote part of the total mass flow, come from the GC, from the GC pressure to the ETE evap. Pressure. It works to maintain the SH at the outside of the P.H.E. ETE, before the COMPR. ETE. PS 120bar.
	P.H.E. ETE	Plate Heat Exchanger of ETE	Component	Heat exchanger dedicated to the sub-cooling of the mass flow come from GC. PS 120bar.
	COMPR. ETE	Compressor of ETE	Component	Dedicated compressor with inverter for the ETE with dedicated suction. It works at very high-pressure level (40-45 bar). Same compressor type of the other one of the pack. PS 100bar at suction.
	VM-SUB	2-Way Motorized Valve OR Only ball valve	Component	Positioned above the EEV ETE, the function is below described.  **THE PRESENCE OR NOT OF THE MOTOR AFFECT THE EEV STAND-BY PARAMETER**
	ST-Gc	Temperature at the outside of GC	Temp. probe	Temperature at the outside of the gas cooler. It gives the consent to the 2-way motorized valve to open and to the EEV controller. Is the same temp. probe of HPV valve.
	ST-OUT-SUB	Temperature at the outside of ETE	Temp. probe	Temperature at the outside of the ETE and at the inlet of the HPV (only read).

© EPTA GROUP – ALL RIGHTS RESERVED

The system concept layout for the ETE:



© *EPTA GROUP – ALL RIGHTS RESERVED*

2. About controller

For the ETE, two additional controllers are located inside the pack electrical board:

- pRack300 Small/pRack300 Compact: to manage the compressor of the ETE

- EVD: to manage the EEV of the ETE

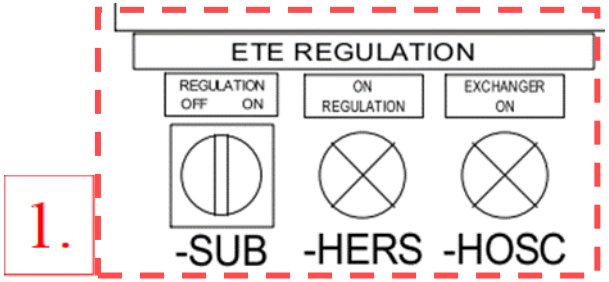
© *EPTA GROUP – ALL RIGHTS RESERVED*

2.1 Logic of ETE activation

The ETE will activate in summer and mid-season periods in order to subcooling the CO2 refrigerant at the inlet of the Transcritical valve. The subcooling effect permits to use of the CO2 transcritical system when the external temperature is above 40 °C, reducing significantly the amount of the flash gas product by the system.

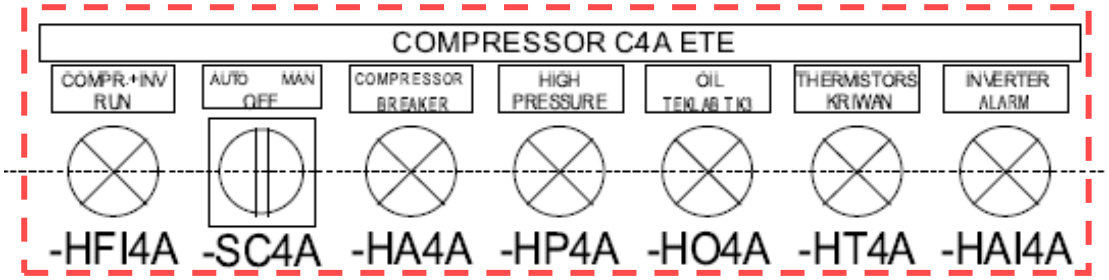
From controller point of view, the activation of ETE will be if the following conditions are satisfied:

1. Selector **SUB** of the **ETE REGULATION** in pack electrical board in **ON**, the KERS is activated:
    a. pRack300 Small/pRack300 Compact is in ON from digital input and it is ready for regulation in pressure
    b. The light HERS in front of electrical board switches on
2. Selector of the **COMPRESSOR C4A SUBCOOLER** in pack electrical board in **AUTO**;
3. Selector **SVSU** of the **SUBCOOLER 2 WAY VALVES** in pack electrical board in **ON** (it refers to **HOSU** light); ***(IF THE MOTOR IS PRESENT)***

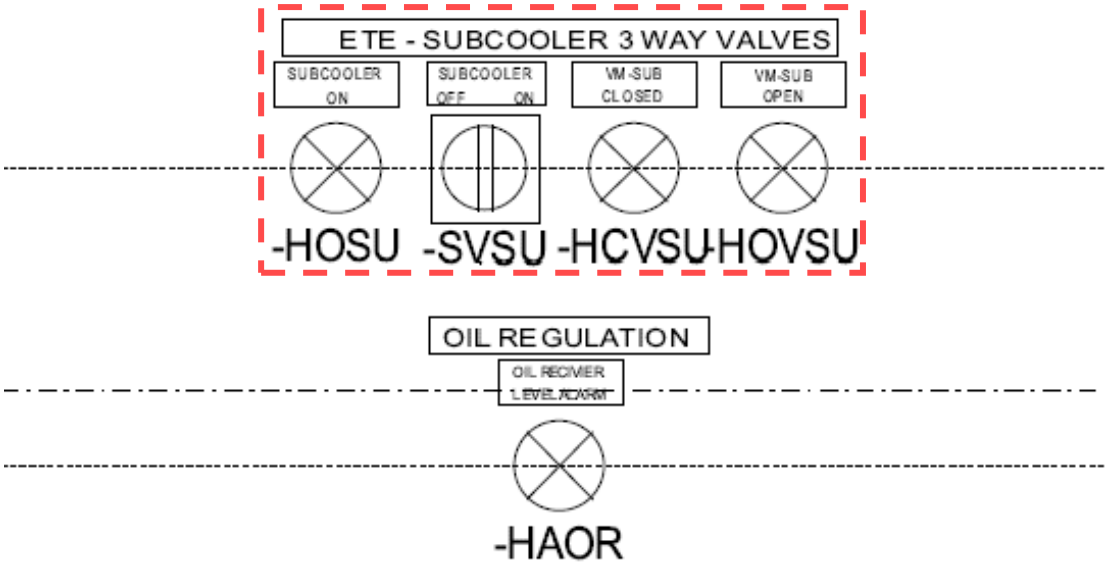


© EPTA GROUP – ALL RIGHTS RESERVED

2.



3.



© *EPTA GROUP – ALL RIGHTS RESERVED*

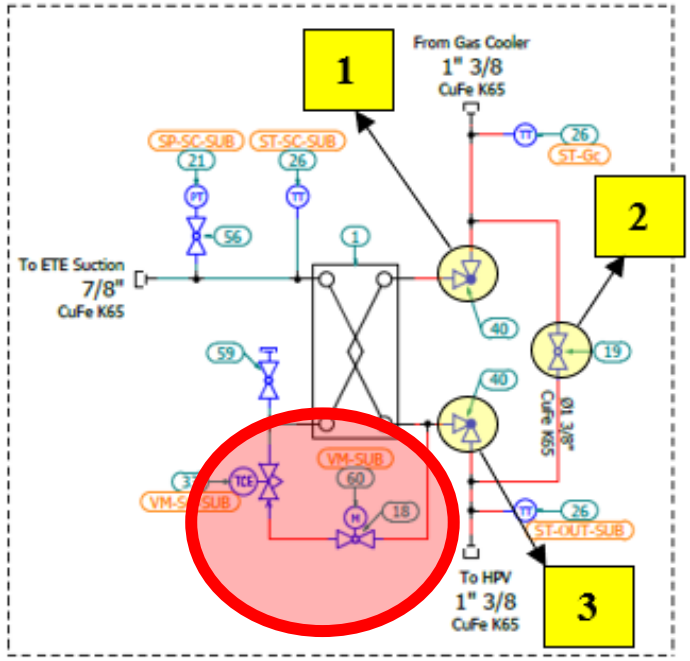
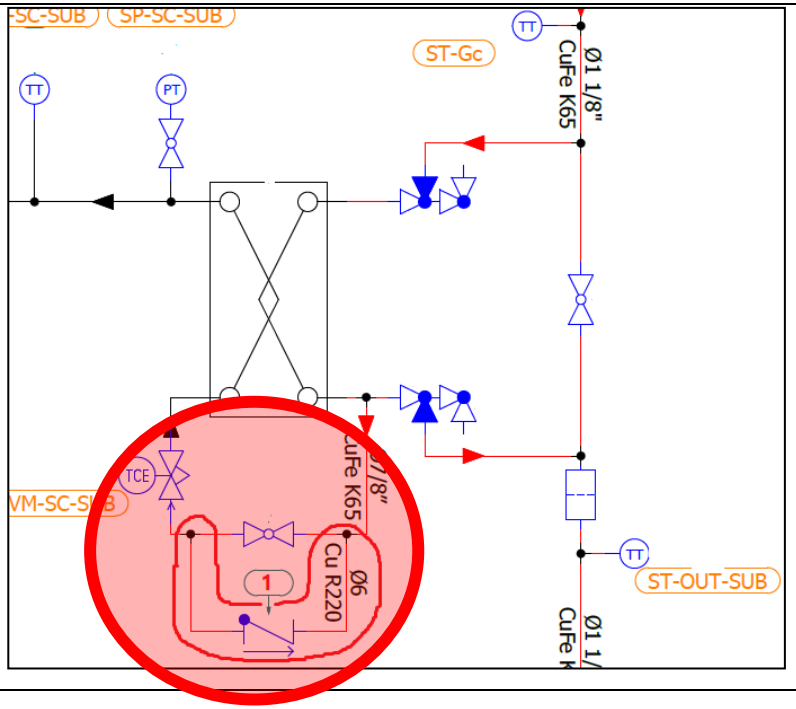
4. IF:
   a. At least 1 MT compressor is running (relè KM13.2 active);
   b. Inverter of the ETE compressor is in NO alarm state ad ETE compressor in NO alarm state (relè KA4AT active);
   c. T OUT GC (ST-GC and ST-BK-GC) is above the *generic temperature function n° 3 + differencial* (generic function in the pRack300T Large, main pack controller – *check in the wiring diagram the correct number of general thermostat function configurated*).

➔ KOSC is activated and the light HOSC in front of electrical board switches on.

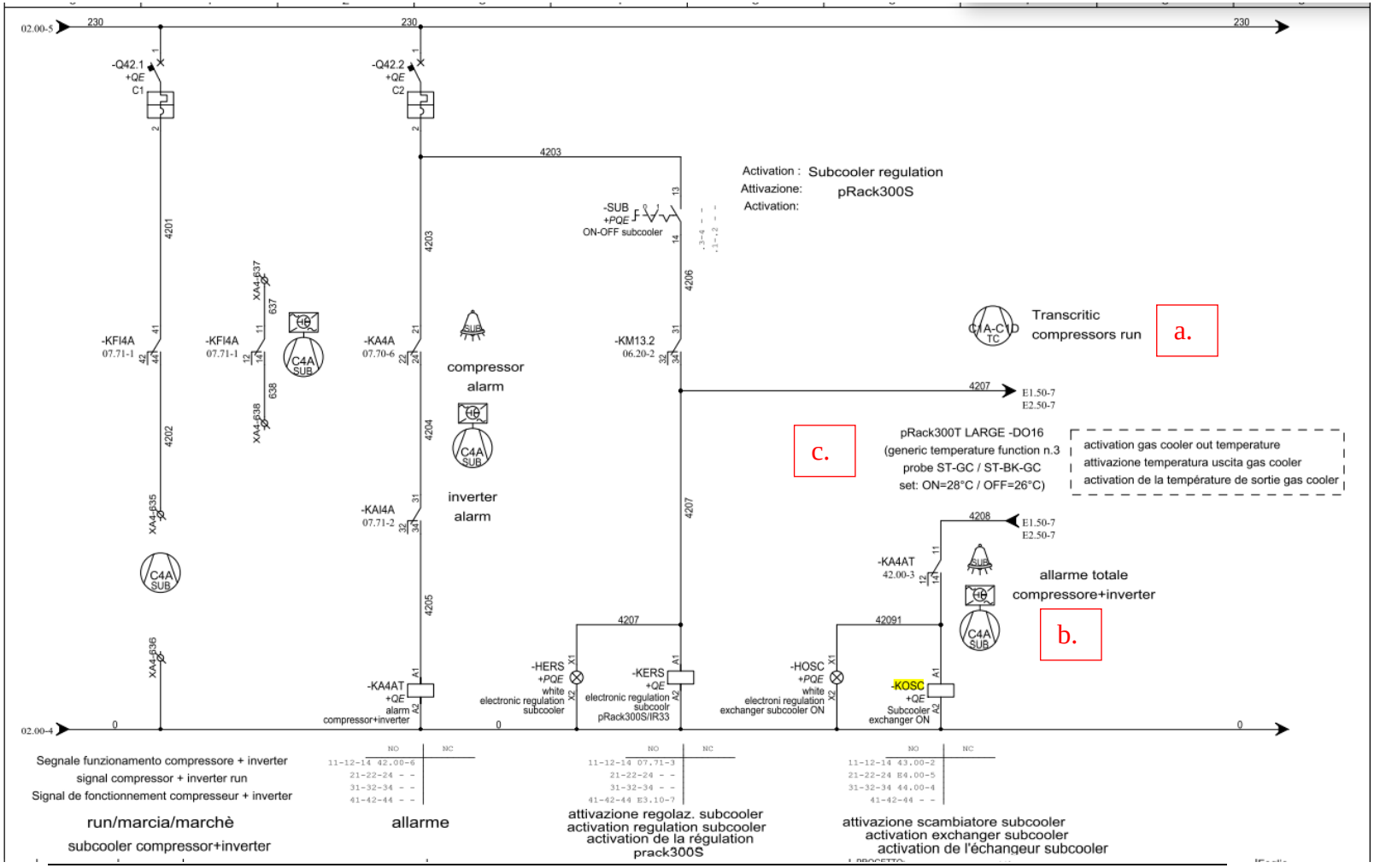
When KOSC is active:

	5. **IF THE MOTOR IS PRESENT** the VM-SUB (2-Way Motorized Valve managed by K3WSU) open (HOVSU light switches on);
	6. it is enabled from digital input the regulation of EVD. The VM-SC-SUB (ETE EEV) starts to open and to check the superheat after the P.H.E. ETE;

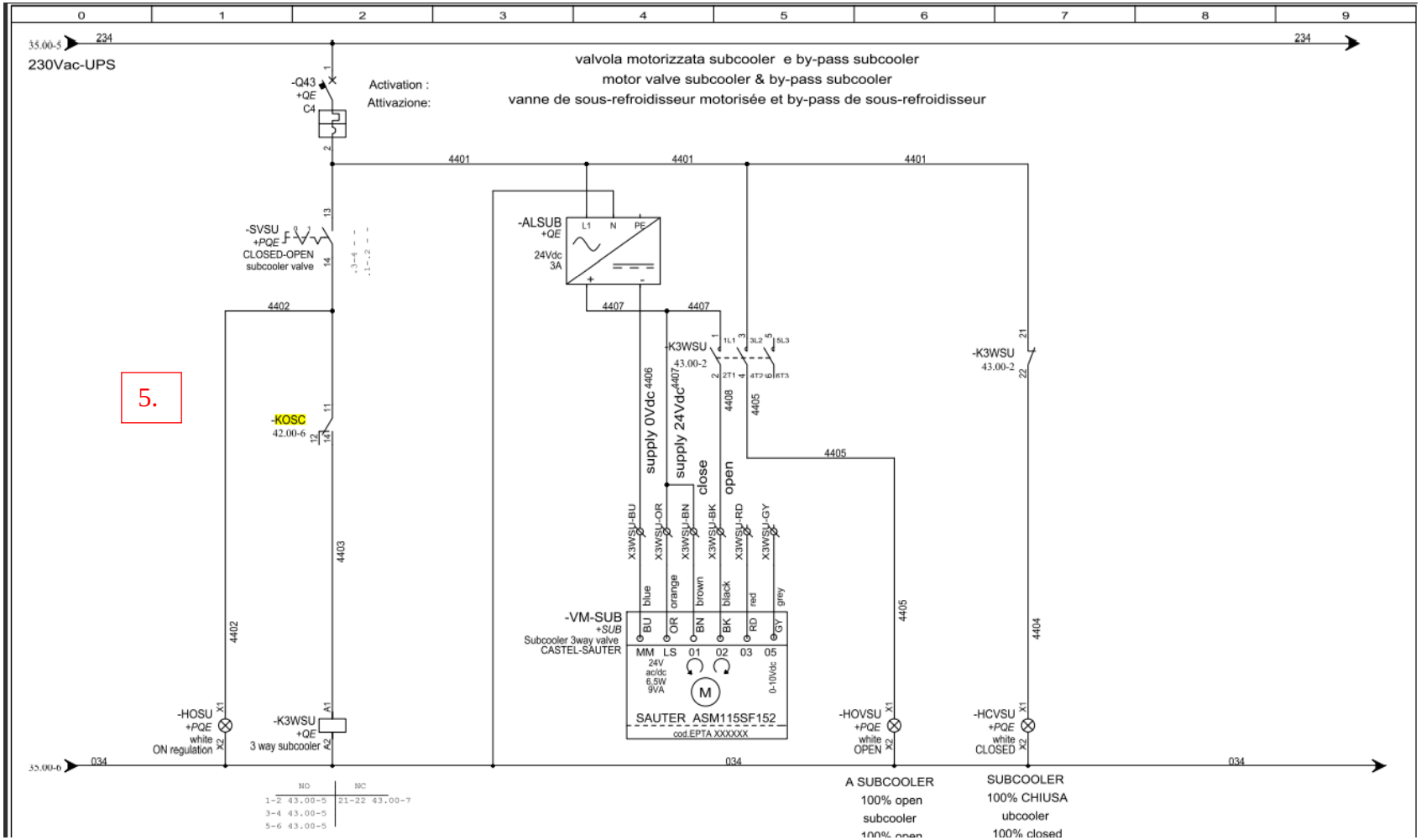
© EPTA GROUP – ALL RIGHTS RESERVED

IF THE MOTOR IS PRESENT when the driver is in off the valve is open 11% (min % open) to avoid liquid trap during stand-by phase. Due to the increasing pressure inside the suction pipe, the ETE compressor will start running.	**IF THE MOTOR IS NOT PRESENT** (ONLY BALL VALVE and CHECK VALVE) when the driver is in off the valve is completely closed (0% open)
	

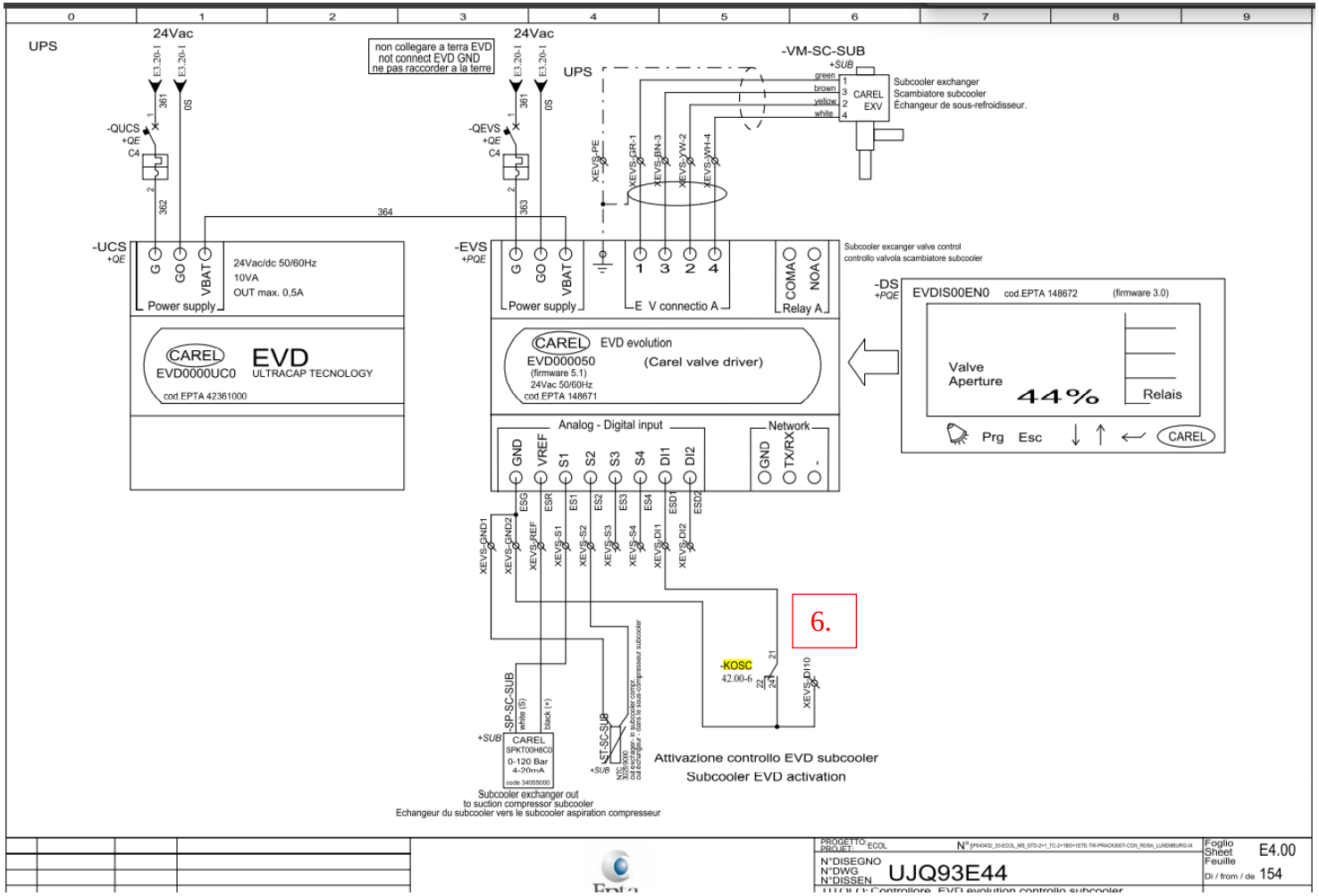
© *EPTA GROUP – ALL RIGHTS RESERVED*



© *EPTA GROUP – ALL RIGHTS RESERVED*



© *EPTA GROUP – ALL RIGHTS RESERVED*



© *EPTA GROUP – ALL RIGHTS RESERVED*

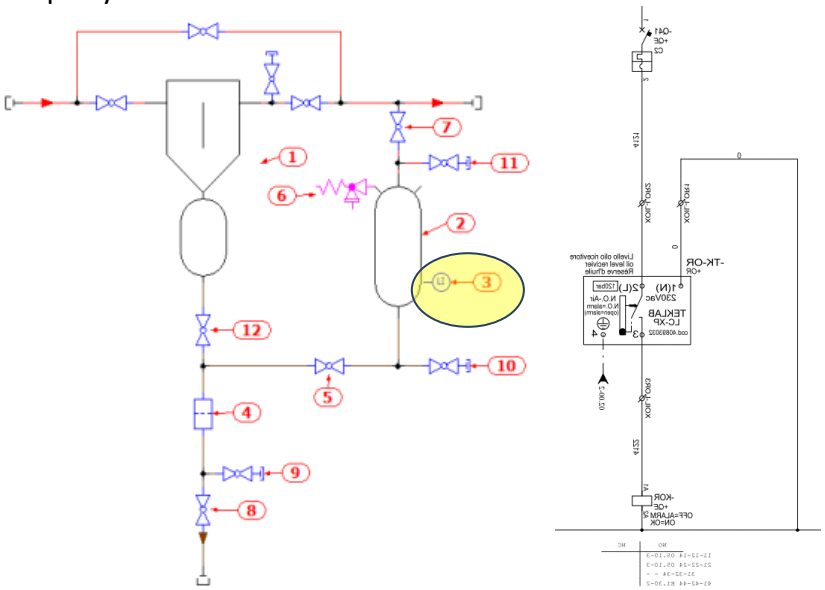
2.2 Oil system

The new oil system consists of:

- Oil separator with integrated reserve
- Oil Reserve

The whole oil system has security pressure of 120bar and follows the gas cooler pressure. Stainless steel AISI 304L is used for piping.

The separator recovers the oil present in the refrigerant and through the connection between the separator and the reserve, the oil level is distributed equally between the two volumes.



In the lower half of the reserve there is the oil level sensor (3) with the only purpose to highlight a low level of oil in the system.

The alarm is visible in the pRack300T Large (main pack controller).

For more info refer to document SE-TS0050R00.

© *EPTA GROUP – ALL RIGHTS RESERVED*

3. Before the commissioning

Check the following parameters/components before the commissioning of the ETE.

1. Charge the pack of oil following the SE-TS050R00 guideline
2. Check if the pRack300 Small end the EVD are visible from remote on the BOSS
3. Check in the pRack300 Small if the compressor control is in **Neutral zone** (Not in Proportional band)
4. Check the limit of the ETE compressor inverter (change in prack300 S as well as in inverter of ETE compressor):

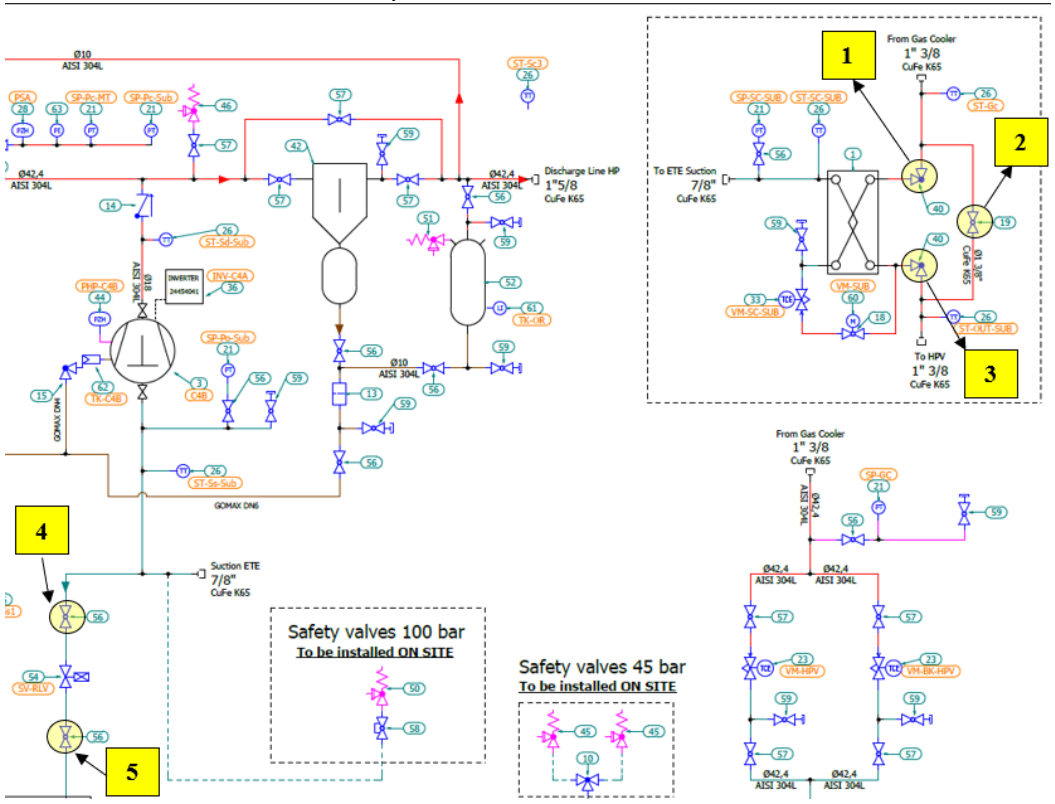
Value	U.M.	Short desc
60	Hz/%	MAD_INVERTER_COMP_MING_L1_MAX_F
25	Hz/%	MAD_INVERTER_COMP_MING_L1_MAX_F

5. Check the parameters in the EVD (possible from supervisor in parameters menu of EVD):

Value	U.M.	Short desc
80	sec	PID_Ti
18	°C/°F	MOP_THRESHOLD
11	K/°F	SH_SET
5	K/°F	LOW_SH_THRESHOLD

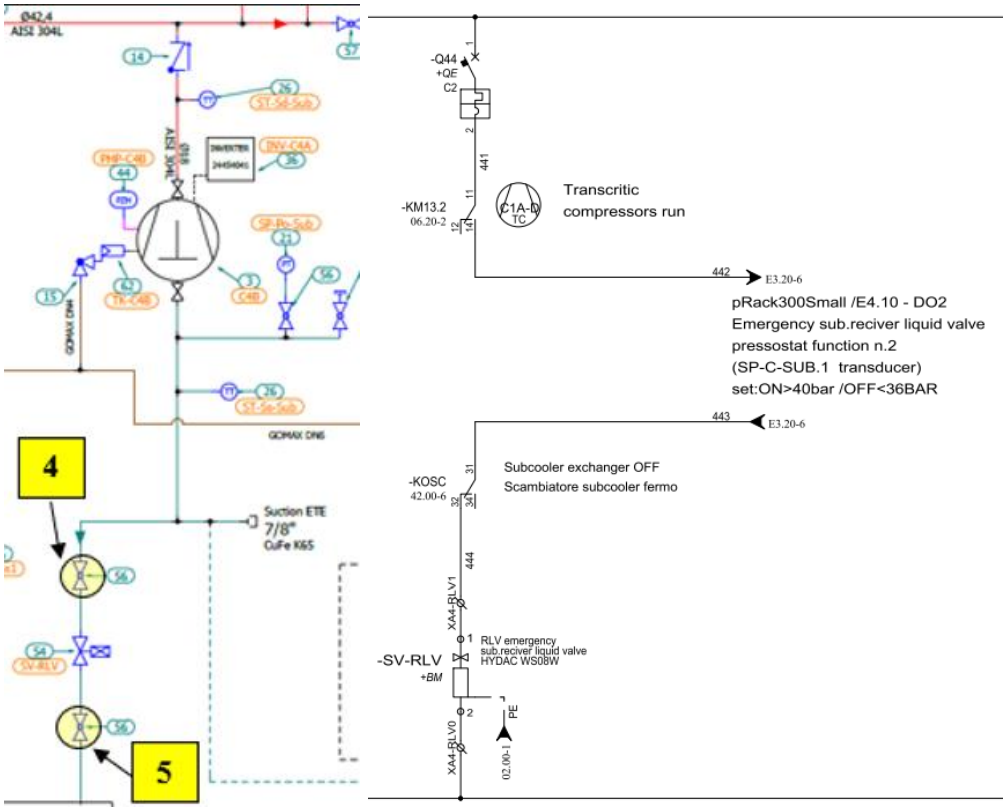
© EPTA GROUP – ALL RIGHTS RESERVED

6. To activate the ETE, check the position of the following shut off valves:
   - Open shut off valves 1 and 3, close 2
   - Open 4 and 5
   - Check the shut off valve on teklab of the ETE compressor



© *EPTA GROUP – ALL RIGHTS RESERVED*

3.1 Safety element in the ETE system



Between the ball-valves 4 and 5 there is the solenoids valve SV-RLV.

The SV-RLV is activated if there are some of the following situation:

- Leakage from non-return valve of ETE compressor (when compressor is not running)
- Malfunction of the ETE EEV (VM-SC-SUB)

This valve will be excited when <u>one</u> of the following conditions is satisfied:

- ETE compressor and/or ETE inverter are in ALLARM
- T OUT GC (ST-Sd) is BELOW the *generic temperature function n° 3* (*)

AND (<u>all</u> satisfied):

- the pressure on the ETE compressor suction (Sp-Po-SUB transducer) is above pressure switch function n.2 (*) in pRack300 Small/pRack300 Compact (set: ON>40bar / OFF<36bar)
- at least 1 MT compressor is running
- KERS relay is active (Selector of SUB in ON)

(*) check in wiring diagram the correct number of pressure switch function (in pRack300 Small) and generic temperature function (in pRack300T Large) are configurated.

© EPTA GROUP – ALL RIGHTS RESERVED

4. Commissioning

To star the ETE technology the following actions must be done.
Remember that the running of ETE is strongly related to the external condition. In general, it is worthy to star the ETE when temperature at outlet of the gas cooler is above the ETE starting set (default = 27 °C).
If the external conditions are enough, the commissioning can start.

1. Selector **SUB** of the **ETE REGULATION** in rack electrical board in **ON**;
2. Selector of the **COMPRESSOR Cx4A SUBCOOLER** in rack electrical board in **AUTO**;
3. Selector **SVSU** of the **SUBCOOLER 3 WAY VALVES** in rack electrical board in **ON**;
4. Check the parameters in the pRack300 Small (possible from supervisor in parameters menu of ETE's compressor controller):

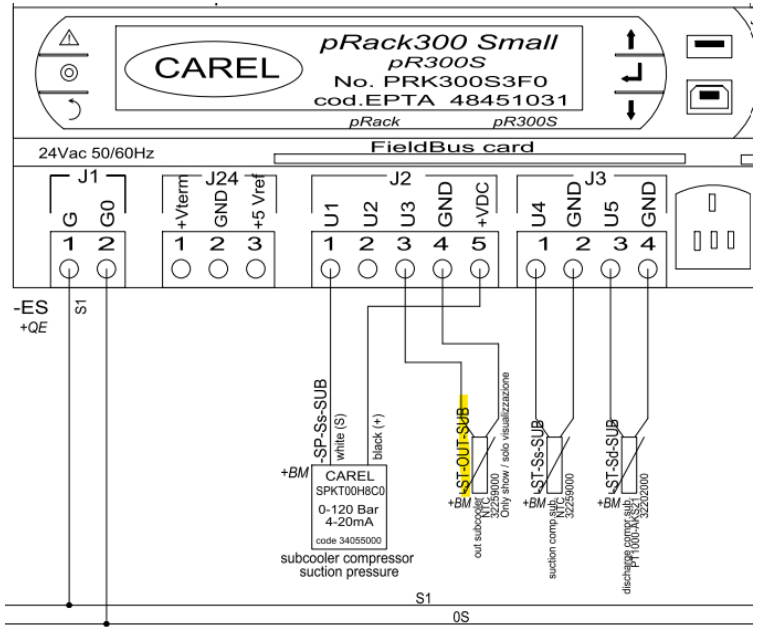
Value	U.M.	Short desc
43	barg/psi/°C/°F	Setpoint_Comp_L1
5	barg/psi/°C/°F	Reg_Comp_Diff_L1
40	sec	MOD_INVERTER_COMP_MNG_L1_DECR_
2	barg/psi/°C/°F	Reg_Comp_Diff_Incr_NZ_L1
4	barg/psi/°C/°F	Reg_Comp_Diff_Decr_NZ_L1

© EPTA GROUP – ALL RIGHTS RESERVED

5. Check the *generic function n° 3* on the pRack300T Large (also from Boss):
   - *generic function n° 3 setpoint*= about 27 °C
   - *generic function n° 3 differential* = about 2K

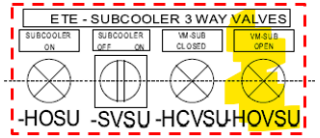
   (the values could change from pack to pack and it depends about the size of the ETE compressor and the city of installation)

6. Rename the *L1 – Generic probe X* in the pRack300 S (ETE controller) as T out ETE (**ST-SC-SUB** → the temperature probe at the outside of the ETE heat exchanger) to check the value from remote



© EPTA GROUP – ALL RIGHTS RESERVED

7. HCVSU switch off and HOVSU on:



8. Verify the opening of the EEV of ETE: it starts to regulate to maintain the SH at 11K.
9. Due to the increasing pressure inside the suction pipe, the ETE compressor will start running.
10. The ETE system should run and in order to see the subcooling effect:
    - *L1 – Generic probe X* in the pRack300 S (compared it with the T out GasCooler. The difference of the two probes is the subcooling delta)
    - *Flash Gas % opening*
    - *Main liquid receiver pressure*
11. Check the status of main rack in order to be sure that system has achieve the balance (main liquid receiver, HPV valve, Flash Gas valve etc..)
12. AS EXAMPLE, if properly commissioned, typical situation in summer period could be:
    - T out GC = 39 °C
    - p GC = 95bar
    - T out ETE = 20 °C
    - Flash Gas % = 7%
    - p main liquid receiver = 36bar

© EPTA GROUP – ALL RIGHTS RESERVED